

Name : \_\_\_\_\_

Chemistry 129      Spring 2017

General Chemistry

Examination #3:

Equations are provided.

You may use a calculator.

**Show all your work!**

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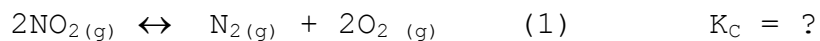
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Bonus: \_\_\_\_\_/2

Total: \_\_\_\_\_/100

1. (12%) (a) Find K for the following reaction:



Use the following data to find the unknown  $K_{\text{C}}$ .



(b) When this reaction (1) comes to equilibrium, will the reaction mixture contain mostly reactant or mostly product? Why?

2. (12%) Classify the following salts as basic, acidic or neutral.

(i)  $\text{NH}_4\text{I}$  \_\_\_\_\_

(ii)  $\text{CsNO}_2$  \_\_\_\_\_

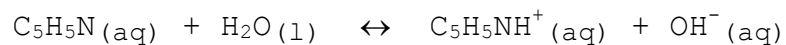
(iii)  $\text{Ba}(\text{ClO}_3)_2$  \_\_\_\_\_

(iv)  $\text{NaF}$  \_\_\_\_\_

(v)  $\text{Cr}(\text{NO}_3)_3$  \_\_\_\_\_

(vi)  $\text{KBr}$  \_\_\_\_\_

3. (20%) Consider the ionization of pyridine:

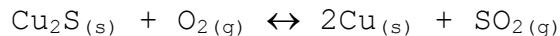


A 0.100M pyridine solution has a pH of 10.12. Determine the value of pyridine's base-ionization constant ( $K_b$ ) and the equilibrium concentrations of  $\text{C}_5\text{H}_5\text{N}$ ,  $\text{C}_5\text{H}_5\text{NH}^+$ , and  $\text{OH}^-$ .

4. (10%) (a) Which of the following acids has the larger  $\text{pK}_a$ :  **$\text{HNO}_3$**  or  **$\text{HNO}_2$** . Explain.

(b) What is the chemical formula of the conjugate base of each of the acids in (a). Which is the stronger base? Explain.

5. (14%) The following reaction is exothermic.

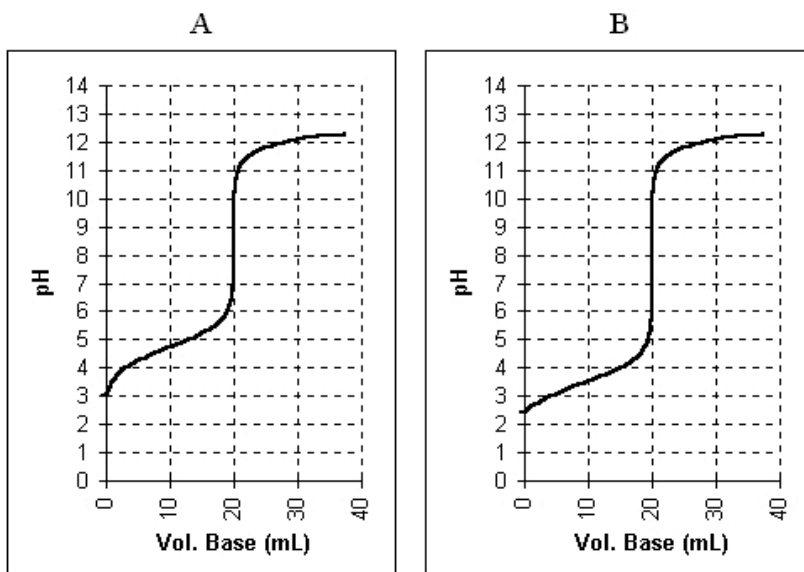


(a) Predict the effect (shift right, shift left, or no effect) of the following:

- i. Adding more  $\text{O}_2$  to the reaction mixture - \_\_\_\_\_
- ii. Increasing the temperature of the reaction mixture - \_\_\_\_\_
- iii. Adding more  $\text{Cu}$  to the reaction mixture - \_\_\_\_\_
- iv. Removing some  $\text{SO}_2$  from the reaction mixture - \_\_\_\_\_
- v. Compressing the vessel volume in half - \_\_\_\_\_
- vi. Adding a catalyst to the reaction mixture - \_\_\_\_\_

(b) Will the equilibrium constant of the reaction increase or decrease if the temperature is decreased? Why?

6. (7%) Two unknown acid samples are studied by titration with a 0.100 M NaOH solution. One sample is **aspirin** (acetylsalicylic acid,  $\text{pK}_a = 3.52$ ), and the other is **vinegar** (acetic acid,  $\text{pK}_a = 4.74$ ). Which titration curve corresponds to which acid? Briefly explain.

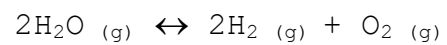


7. (25%) Consider the titration of 30.00mL of 0.250M benzoic acid ( $\text{C}_6\text{H}_5\text{CO}_2\text{H}$ ),  $\text{pK}_a = 4.20$ , with 0.300M KOH. Determine the equivalence volume and the pH at the following volumes of KOH added: **0 mL, 18.0mL, equivalence volume and 30.0mL**. Make sketch of the titration curve.



Bonus (2 pts):

Consider the following reaction:



If the reaction shifts right when the temperature is increased, is the reaction endothermic or exothermic?